

## **AMENDMENTS TO THE SPECIFICATION**

Please replace the paragraph beginning at **page 18, line 11**, and insert the following rewritten paragraph:

Next, a method of estimating a joint moment of a biped walking mobile body in accordance with the present invention is a method of estimating a moment acting on at least one joint of each leg of a biped walking mobile body by using an estimated value of the position of a floor reaction force acting point successively determined by the floor reaction force acting point estimating method according to the present invention described above. And this joint moment estimating method includes a step for successively estimating the floor reaction force of each leg, which is in contact with the ground, of the biped walking mobile body by using at least a detection output of an acceleration sensor attached to a body of the biped walking mobile body to detect the acceleration of a predetermined part of the body of the biped walking mobile body and a detection output of a body inclination sensor attached to the body to detect an inclination angle of the body, and a step for successively grasping the inclination angle of each rigid corresponding part of a biped walking mobile body that corresponds to each rigid body of a rigid link model representing the biped walking mobile body in the form of a link assembly of a plurality of rigid bodies, the acceleration of the center of gravity of the rigid corresponding part, and the angular acceleration of the rigid corresponding part by using at least detection outputs of the body inclination sensor and an angle sensor attached to a joint to detect the bending angle of a joint of each leg of the biped

walking mobile body, wherein the moment acting on at least one joint of each leg of the biped walking mobile body is estimated on the basis of an inverse dynamics model by using an estimated value of the floor reaction force, an estimated value of the position of the floor reaction force acting point, an inclination angle of the aforesaid each rigid corresponding part, an acceleration of the center of gravity of the rigid corresponding part and an angular acceleration of the rigid corresponding part, the weight and size of each rigid corresponding part determined in advance, the position of the center of gravity of each rigid corresponding part in the rigid corresponding part determined in advance, and an inertial moment of each rigid corresponding part determined in advance.

Please replace the paragraph beginning at **page 24, line 2**, and insert the following rewritten paragraph:

The joint moment estimating method in accordance with the present invention makes it possible to estimate, in real time, the moment acting on a joint of a leg by relatively simple arithmetic processing by using the an estimated value of the position of a floor reaction force acting point estimated according to the floor reaction force acting point estimating method in accordance with the present invention described above so as to estimate the moment acting on a joint of a leg, thus obviating the need for preparing multiple types of correlation data beforehand or for attaching a relatively large sensor or the like to a biped walking mobile body.

Please replace the paragraph beginning at **page 39, line 9**, and insert the following rewritten paragraph:

In Fig. 2, the components marked with ~~parenthesized~~ reference numerals 24 are ankle joint angle sensors that output signals based on the bending angles of the ankle joint 12 of each leg 2, and are related to the second embodiment, which will be discussed later. In the present embodiment (the first embodiment), the ankle joint angle sensors 24 are unnecessary and not actually provided.

Please replace the paragraph beginning at **page 74, line 16**, and insert the following rewritten paragraph:

where  $M_1$  in Equation ~~(13)~~(11) denotes the moment obtained in terms of the outer product (vector product) of the floor reaction force acting point vector determined as described above by the floor reaction force acting point estimating means 38 on the leg 2 having the crus 11 related to Equation ~~(13)~~(11) and the floor reaction force vector determined by the floor reaction force estimating means 39 on the leg 2. Further,  $\alpha_2$  denotes the angular acceleration of the crus 11 determined by the means 36 for calculating the angular acceleration of each portion of a leg. Further,  $\theta_d$  denotes the inclination angle of the crus 11 determined by the leg posture calculating means 29. Further,  ${}^T(F_{1x}, F_{1z})$  denotes the estimated value of a floor reaction force determined by the floor reaction force estimating means 39 as described above. Further,  ${}^T(F_{2x}, F_{2z})$  is determined according to the above Equation ~~(12)~~(10). Further, the inertial moment  $I_{G2}$  is determined together with the data or the

like of the weight  $m_2$  and size of the crus 11 and stored in the arithmetic processing unit 16 beforehand.

Please replace the paragraph beginning at **page 82, line 15**, and insert the following rewritten paragraph:

Referring to Fig. 2, according to the present embodiment, in a human being 1, an ankle joint angle sensor 24 that outputs a signal corresponding to a bending angle  $\Delta\theta_e$  of an ankle joint 12 is attached to the ankle joint 12 of each leg 2, in addition to the devices explained in the first embodiment. As in the knee joint angle sensor 23 or the like, the ankle joint angle sensor 24 is composed of a potentiometer, and secured to the ankle joint 12 through a belt or the like, which is not shown. Further, the ankle joint angle sensor 24 is connected to an arithmetic processing unit 16 through a signal line, which is not shown, to input its outputs to the arithmetic processing unit 16.

Please replace the paragraph beginning at **page 83, line 1**, and insert the following rewritten paragraph:

Here, the bending angle  $\Delta\theta_e$   ~~$\Delta\theta_d$~~  detected by each ankle joint angle sensor 24 denotes the angle formed by the line, which connects the center of the ankle joint 12 and the center of an MP joint 13a of a foot 13 linked to the ankle joint 12, and the axis of a crus 11.

Please replace the paragraph beginning at **page 88, line 26**, and insert the following rewritten paragraph:

After the distance between the ankle joint and the ground contact surface is grasped as described above, the vertical position (the position in the z-axis direction) of a floor reaction force acting point is determined as the position vertically apart downward from the position of the ankle joint 12 by the grasped distance between the ankle joint and the ground contact surface in the same manner as that in the first embodiment. In other words, the vertical position (the position in the bodily coordinate system  $C_p$ ) of the floor reaction force acting point is determined as the value obtained by subtracting the distance between the ankle joint and the ground contact surface, which has been grasped as described above, from the value of the z-axis component of the position of the ankle joint 12 (the upward direction being defined as the positive direction of the z-axis).